



EVALUATING EFFICACY OF UTERINE ARTERY DOPPLER IN 18- 22 WEEKS OF PREGNANCY TO PREDICT ADVERSE PREGNANCY OUTCOME : AN OBSERVATIONAL STUDY

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ABSTRACT **Background:** Antenatal care aims to identify and manage high-risk pregnancies and complications. Uterine artery Doppler, a non-invasive test, assesses utero-placental circulation. A high Pulsatility Index can indicate impaired placentation. This study investigates the role of second-trimester uterine artery Doppler PI in predicting adverse fetal outcomes. **Methodology:** This prospective cohort study included 63 women with singleton pregnancies, between 18 and 22 weeks of gestation, attending the Obstetrics and Gynecology department at SMS Medical College, Jaipur from November 2022 to November 2023. Participants provided informed consent and met inclusion and exclusion criteria. Uterine artery Doppler PI (UtA PI) and a targeted second-trimester anomaly scan were conducted. The cutoff value for PI was set at >1.5 . **Results:** The study found that uterine artery PI is a strong predictor of early adverse pregnancy outcomes. Among the 63 patients, 11.1% (n=7) developed hypertensive disorders, 4.7% (n=3) experienced fetal growth restriction (FGR), and 1.6% (n=1) had spontaneous preterm birth. Additionally, 9.5% (n=6) of neonates had an APGAR score <7 . UtA PI predicted FGR with 100% sensitivity and 96.7% specificity (p=0.004). However, the prediction of hypertensive disorders was not statistically significant (p=0.08). **Conclusion:** Uterine artery Doppler PI is a promising tool for predicting adverse pregnancy outcomes, particularly FGR, and offers significant value in antenatal care. Further research with larger sample sizes and randomized trials is warranted to validate these findings.

KEYWORDS : Fetal growth restriction, uterine artery Doppler, pulsatility index, second trimester

INTRODUCTION

The field of obstetrics is integral to the management of human reproduction, profoundly impacting both maternal and neonatal health. This significance is evident as maternal and neonatal outcomes serve as critical indicators of health quality and healthcare standards across nations. Effective obstetric care hinges on the ability to assess and manage high-risk pregnancies through informed, timely interventions. This approach is crucial in identifying potential complications and ensuring favorable outcomes.

³In developed countries, pregnancies are typically well-managed with few complications, leading to generally positive outcomes for both mothers and infants. However, in developing regions, adverse outcomes are more prevalent. The most severe complications include maternal and neonatal mortality, but even in cases where survival is achieved, complications can lead to significant morbidity. One major contributor to these adverse outcomes is vascular-related pregnancy complications, which are often linked to issues in placentation—specifically, trophoblast invasion and angiogenesis. These processes are crucial for establishing healthy placental and maternal blood flow, and disruptions can have serious implications.

Uterine artery Doppler studies are a key tool for monitoring pregnancies at risk of fetal growth restriction (FGR). This non-invasive, simple, and effective test evaluates uteroplacental circulation, helping to identify potential complications associated with placental disease. The uterine artery pulsatility index (UtA PI) is a crucial measure used in this context. It represents the ratio of vascular impedance on both the fetal and maternal sides of the placenta, calculated from the difference between peak systolic flow and minimum diastolic flow velocity divided by the mean velocity throughout the cardiac cycle.

²Abnormalities in placentation or implantation can increase the risk of various complications, including miscarriage, pre-eclampsia, abruptio placentae, intrauterine fetal death, and FGR. To aid in early prediction of adverse pregnancy outcomes, various biochemical markers and imaging techniques have been employed. These include PAPP-A, sFlt-2, PLGF, activin, inhibin-A, homocysteine levels, and uterine artery Doppler studies. This study focuses on the uterine artery Doppler pulsatility index in the second trimester as a predictive tool for adverse pregnancy outcomes.

METHODOLOGY

This study was a prospective cohort investigation conducted from November 2022 to November 2023 at SMS Medical College, Jaipur. It

involved 63 women with singleton pregnancies between 18 to 22 weeks of gestation, attending the outpatient department of Obstetrics and Gynecology. Participants provided written informed consent and met specific inclusion and exclusion criteria.

INCLUSION CRITERIA

1. Women with uncomplicated, singleton pregnancies resulting from spontaneous conception.
2. Women between 18 to 22 weeks of gestation.
3. Women aged 20 to 35 years who consented to participate and were not involved in other studies.

EXCLUSION CRITERIA

1. Women receiving thromboprophylaxis.
2. Women with chronic hypertension, multiple gestation, diabetes mellitus, systemic lupus erythematosus (SLE), thrombophilias, severe anemia, pre-existing cardiovascular or renal diseases.
3. Women with fetal anomalies or chromosomal abnormalities.
4. Women with a history of poor obstetric outcomes or previous pregnancy losses.

Following consent, participants underwent a uterine artery Doppler pulsatility index assessment as part of their second trimester anomaly scan. An UtA PI above the 90th percentile (>1.5) for gestational age was considered abnormal.

Patients were monitored until delivery, with key outcomes assessed including hypertension, FGR, pre-term birth, gestational age at delivery, birth weight, and APGAR scores. Data was collected from hospital records and telephone interviews to evaluate the correlation between mid-trimester UtA PI and adverse pregnancy outcomes.

STATISTICAL ANALYSIS

Data analysis was performed using IBM SPSS version 23 software. Statistical significance was determined using the chi-square test and diagnostic measures, including sensitivity and specificity.

RESULTS

Mean Maternal Age: The average age of participants was 27 ± 4 years. Among the 63 participants, 22 (34.9%) were primigravidas (first-time mothers).

-Uterine Artery Pulsatility Index (UtA PI): Only 4 cases (6.3%) showed a high UtA PI (>1.5). Of these, 3 cases (4.8%) underwent cesarean sections (LSCS) due to FGR, and 1 case (1.6%) had an LSCS for two loops of the umbilical cord around the neck.

Predictive Value: The p-value for UtA PI in predicting FGR was 0.004, indicating statistical significance. The test exhibited 100% sensitivity and 96.7% specificity.

HYPERTENSION: Among the 7 patients who developed hypertension during pregnancy, 2 (3.2%) had an elevated UtA PI (p-value = 0.003), which was statistically significant.

Table 1: Distribution of Patients According to Pulsatility Index

UTERINE ARTERY DOPPLER P.I.	No. Of patients
<1	28 (44.4%)
1 – 1.5	31 (49.2%)
>1.51	4 (6.3%)

Table 2: Various Indications for Cesarean Section

Indication for LSCS	Normal investigations	UtA PI Raised	Total
Previous LSCS (with refusal for TOLAC)	4 (6.3%)	0	5 (8%)
Breech	4 (6.3%)	0	4 (6.3%)
Failed induction	2 (3.2%)	0	2 (3.2%)
2 CAN	2 (3.2%)	1 (1.6%)	3 (4.8%)
Big baby	1 (1.6%)	0	1 (1.6%)
MSL	1 (1.6%)	0	2 (3.2%)
CPD	2 (3.2%)	0	2 (3.2%)
FGR	1 (1.6%)	3 (4.8%)	4 (6.3%)
Poor bishops score	1 (1.6%)	0	1 (1.6%)

Table 3: Distribution Of Patients According To Antepartum Complications

Distribution Of Antepartum Complications	Frequency	Percentage
Hypertension only	4	6.34%
FGR only	2	3.17%
Spontaneous preterm labour only	1	1.58%
Hypertension + FGR	1	1.58%
Hypertension + preterm delivery	1	1.58%

DISCUSSION

The ability to predict adverse pregnancy outcomes is vital for effective antenatal care. The uterine artery pulsatility index (UtA PI) has shown promise in predicting complications such as hypertensive disorders and FGR. In this study, an abnormal UtA PI was significantly associated with adverse outcomes, with a p-value of 0.004, sensitivity of 100%, and specificity of 96.7%.

Previous research supports these findings. For instance, ⁴Ademola J. Adekanmi et al. (2022) demonstrated that elevated second-trimester uterine artery Doppler measurements were linked to adverse pregnancy outcomes, with significant predictive value for both maternal and fetal outcomes. Similarly, ³Shinde T et al. (2021) found that the mean pulsatility index at 11-14 weeks gestation was a strong predictor of hypertensive disorders, with high sensitivity and specificity.

⁶Anjali R. Chavda et al. (2020) also noted that abnormal umbilical artery Doppler measurements were associated with various complications, including preterm delivery and low birth weight. These studies underscore the value of Doppler imaging in predicting adverse outcomes and highlight its potential role in routine antenatal care.

LIMITATIONS OF THE STUDY

Despite its prospective design, this study faced limitations. The small sample size and the low incidence of abnormal UtA PI may have affected the generalizability of some results. Larger studies are needed to confirm these findings. Additionally, this study focused solely on UtA PI, whereas other parameters like resistance index (RI) and diastolic notch, used in previous studies, could provide a more comprehensive assessment of Doppler patterns and their predictive value.

CONCLUSION

Early identification and management of high-risk pregnancies are crucial for optimal antenatal care. While various tools exist for

predicting adverse outcomes, their accessibility and cost can be limiting. This study demonstrates that elevated uterine artery pulsatility index in the second trimester is associated with a higher risk of adverse outcomes, including fetal compromise, with high sensitivity and specificity. Although further research with larger sample sizes is needed, these findings suggest that UtA PI could be a valuable addition to routine antenatal screening, enhancing the prediction of poor neonatal outcomes and improving overall maternal and fetal care.

ETHICAL CLEARANCE

Institutional review board and ethical committee clearance were obtained for this study.

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